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MOTHS and BUTTERFLIES



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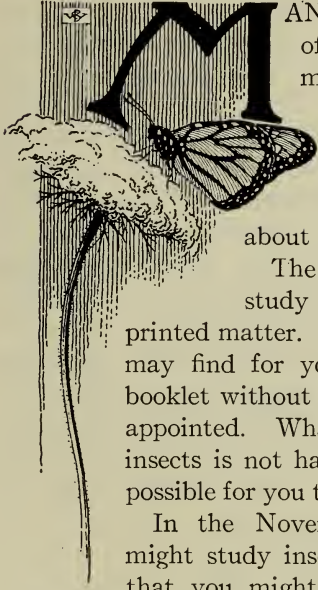
CORNELL RURAL SCHOOL LEAFLET

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NUMBER 4

MOTHS AND BUTTERFLIES



ANY of you found the November, 1922, Leaflet of interest because it told something about moths and butterflies. It dealt with but four moths and one butterfly, however, and since you still send inquiries to the Leaflet office concerning all sorts of butterflies and moths, I am writing this to help you know more about them.

The best way to learn about these insects is to study them without the use of this or of any other printed matter. If this little booklet helps you with what you may find for yourselves, it will be useful; if you use the booklet without studying the insects themselves, I will be disappointed. What I or anyone else may write about these insects is not half so important or interesting as what it is possible for you to find if you will apply yourselves to the task.

In the November, 1922, Leaflet, I suggested that you might study insects as members of a great three-ring circus; that you might consider the cankerworms, which let themselves down from the tree-tops on silken ropes, as acrobats that hang by their teeth from the ridgepole of the tent; and that the tents of our circus might be seen in the nests of the tent caterpillars, such as you may find in cherry or apple trees. If I remember correctly, I told you that the moths and the butterflies might be considered as clumsy creatures that eventually changed their caterpillar attire and came out in spangled uniforms in which they were able to fly from one high perch to another with perfect safety. Their ability in this connection was much greater than the ability of any living human acrobat that ever belonged to a circus.

THE MYSTIC ORDER OF LEPIDOPTERA

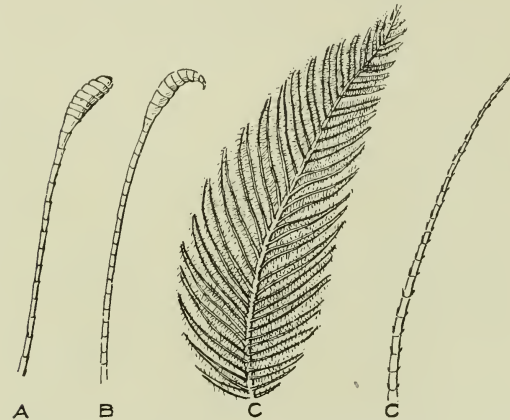
If you will look in a zoology textbook you may notice that people put moths and butterflies into a group which they call the Order *Lepidoptera*. This word order may make you think of the Order of the Knights of Columbus, of the Order of Masons, or possibly of the Order of the Moose. In human society, groups of people have set up these orders, admission to which implies that a candidate must have certain characteristics. He must have certain religious, racial, civic, moral or ethical beliefs to qualify for membership. Some orders of human society have standard uniforms.

In some, your table manners may be a factor which will determine whether you may be admitted or rejected for membership.

To get into the Mystic Order of Lepidoptera an insect must have certain characteristics. These characteristics include the possession, when in an

adult stage, of a spangle-covered uniform which may or may not include a pair of wings with which to fly. Generally members of this order do possess these wings. Female cankerworms and female tussock moths are among those that do not. None have wings until they become adults.

If you were a grown-up member of the M. O. L. (Mystic Order of Lepidoptera), your table manners would probably be one of two sorts: either you would



FEELERS, OR ANTENNAE, OF BUTTERFLIES, SKIPPERS, AND MOTHS

A, butterflies; B, skippers; C, moths. These feelers as here represented are much larger than natural size

“suck your soup” through a straw-like mouth which you would be able to curl up under your chin, or you would refuse to eat anything whatever. Only one small group chew their food. As an adult member of this mystic order you would generally be of more use in the world than you were in your younger and more homely days. You might assist many plants in the production of seeds by placing the pollen of their flowers where it can be of most use. You might as an adult lepidopteran expose yourself where birds might see you more easily and feed their young with your body. In all probability as an adult you would be more pleasing to the sight of humans, as well as possibly to the sight of your own kind. As an adult you would have passed the sexless stage, and as a female you might be able to lay eggs or as a male you might be capable of making the eggs which the female lays fertilized and capable of development. If you were a male member of the order, you might possibly possess “feelers” much more branched than those of your prospective wife. The branches of these antennae probably assist the males in picking up messages from the females much as radio “antennae” assist in picking up messages. Just how this is done we, of course, do not know.

We might, if we wished, carry the secret-society idea further in talking of moths and butterflies and say that all members of the Order Lepidoptera

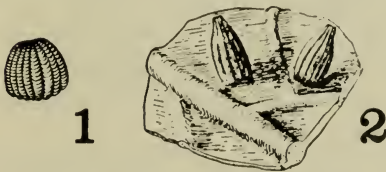
have to go through at least four degrees before they receive their most elaborate regalia. This comparison is not exact, but it is certain that each member of the order starts as an egg. If we consider the egg as the first degree, we might consider the larva, caterpillar or worm, as a member of the second degree. If we did this, we would have to think of the pupa, or resting stage, as representing the third degree. This would leave the fourth degree for the splendor of the adult stage. All members of the order have to go through these stages, and I am perfectly willing for the fun of the thing to think of them as degrees in our secret society. As in human secret societies, each degree has a regalia all its own, and in the second degree, or larval stage, there are many changes to be undergone both in size and in appearance.



EGGS OF POLYPHEMUS MOTH

The first degree — the egg

The eggs of moths and butterflies might be a study in themselves. They are, of course, small for the most part, but, so far as number laid, manner of placing, hatching period, and the like are concerned, there are all sorts of differences. Some members of the order show great care in placing their eggs where their young may have a desirable meal close at hand; others pay no attention to this, merely dropping the eggs wherever convenient. Some conceal the eggs, while others make no effort to do this. Some lay all of their eggs at one time and then die; others continue the process over a considerable time. These are a few of the things you might wish to find for yourselves concerning any particular moth or butterfly you may become interested in. The list of interesting things to look for in connection with moth and butterfly eggs might be stretched indefinitely; it might even include the time of day in which they are laid, since some insects lay their eggs at night and some in the daytime. It might include a study of the length of time between the mating and the laying of the egg, as well as a study of the length of time between the egg laying and the hatching. This would not end your investigations



MOTH AND BUTTERFLY EGGS
Corn-eat worm 2. Cabbage butterfly

because you will find that some of the eggs hatch by breaking open in one way and some in another.

The second degree — the larva, or caterpillar

Members of the second degree of the Order of Lepidoptera are not infrequently spoken of as *worms*. This is fair neither to worms like our earthworms nor to the caterpillars which, as adults, generally rise to heights of complexity never reached by worms.

The function of the second degree is to allow the individual to increase in weight as much as possible. In a few days or weeks the individual must grow from the size of an egg to the size of a full-grown caterpillar.

Naturally this demands a com-



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A CECROPIA CATERPILLAR

This one is changing its skin

bination of a good appetite with good eating tools and an abundance of the desired food. Since most of the energy will be spent on eating, it is wise to be provided with a body that is inconspicuous or that appears undesirable to those creatures which might covet one's body for food. Under these circumstances, it is not surprising to find the caterpillars of moths and butterflies well supplied with jaws for obtaining their food. However, these jaws are not capable of injuring you. As is to be expected, the table manners of all members are essentially alike and all of the moth and butterfly caterpillars chew their food. Sometimes they do this in such a manner that they may be heard in the process, particularly on still nights where large numbers are feeding at a time. This sounds a bit like gentle rain.

Since caterpillars continue to eat, they likewise continue to increase in size. This means that they may get too large for their skins. The result is that they shed their skins and take a new lease on life and begin eating more than ever before. Just look through a tent-caterpillar nest and see if you can find some skins that have been shed. Better still, feed some caterpillars and watch them change their skins. These new skins differ not only in size but in markings, so, if you think that you know how the caterpillar of a certain moth or butterfly looks, you must remember that that caterpillar may have a number of changes of clothes all of which should be known to you if your assumption is really true.

Most caterpillars are particular about what they eat. They will **not** eat "just any old green stuff." If the caterpillar of the monarch butterfly is put in a boxful of parsley leaves, it will probably die, though it could



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LARVAE OF BLACK SWALLOWTAIL BUTTERFLY



LARVA OF MONARCH BUTTERFLY ON MILKWEED

live happily on one milkweed leaf. If, on the other hand, the caterpillar of the black swallow-tail butterfly is put in a box of milkweed leaves, it will probably starve, though it could live happily on the parsley. This peculiar habit of caterpillars of eating but a few or maybe but one kind of plant makes it possible for us to decide whether or not the moth or the butterfly is a friend or a foe of our garden. The monarch butterfly we call a friend, because its caterpillar eats milkweed which we do not want; the black swallowtail we might call a foe, because its caterpillar might eat the parsley which we did want.

It is interesting in connection with the food of caterpillars to note that one kind of caterpillar does not feed upon plant material but feeds upon other insects, the wanderer-butterfly caterpillar does this. Readers of these Leaflets know, of course, that if they wish to find detailed information about particular creatures mentioned in the text, they need merely turn to the life-history charts on pages 36 to 43, inclusive.

Damage by any moth or butterfly to our crops, our stores, or our clothes is done in the caterpillar stage. Beetles, flies, bugs, grasshoppers, wasps, and members of the orders to which they belong may assist or may interfere with us while in the adult stage or when immature. This is not so true with members of the Mystic Order of Lepidoptera.

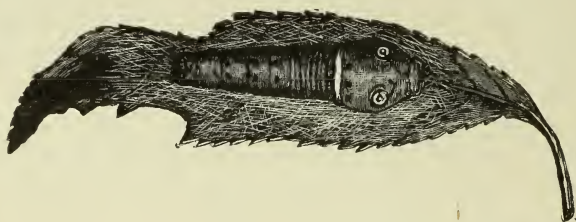
The commonest means used by caterpillars to protect themselves while eating is that of being inconspicuous to their enemies. A few,



LARVA OF TUSSOCK MOTH

The tufts of hairs break off easily and make this caterpillar less desirable as food for birds

like the caterpillar of the io moth, possess stinging hairs which are most unpleasant to us. Some, like the tussock moth and woolly bears, are well supplied with long hairs which may be distasteful. A considerable number are pure bluffs in that they look and act much more dangerous than they really are. One of the biggest bluffers is the larva of the tiger swallow-tail butterfly. It seems to have two large staring eyes, though its real eyes are inconspicuous. It sometimes shows yellow "horns"



CATERPILLAR OF TIGER SWALLOWTAIL BUTTERFLY

This caterpillar is perfectly harmless though a splendid bluffer

which are perfectly harmless. It appears to move its body viciously, though it could not hurt anything if it wished. There are a number of other bluffers among the caterpillars of moths and butterflies.

While we know that caterpillars do not consciously protect themselves by coloring their skins favorably, we could not blame them if they did when we think of the many enemies that they have. Of course from our standpoint, we might think differently in some instances. Birds, many mammals, fish, frogs, salamanders, and even many insects consider caterpillars as necessary parts of their meals. It is fortunate for us that this is so in most cases, since we alone would probably be unable to keep them from eating our food plants. Practically every plant that we use for

food is also used for food by the caterpillars of one or more kinds of moths and butterflies. Nearly every plant that furnishes us with fiber, lumber, and other plant products, furnishes food for moth or butterfly caterpillars. Under these circumstances, we need the assistance of as many allies as possible. Strangely enough our best allies in our warfare against the destructive work of moth and butterfly caterpillars are certain small insects belonging to the same secret order as the wasps and bees.

These little wasp-like creatures lay their eggs on or in the large moth or butterfly caterpillars. From these eggs develop small grubs that live upon the body of the caterpillar, either seriously weakening the caterpillar or killing it. You may sometime find a caterpillar that looks as though it had groups of small white cocoons over it. It is probable that these are the cocoons of one of these wasp-like parasites that feeds upon the caterpillars. It is interesting to know in connection



CATERPILLAR OF IO MOTH

The hairs on the back of this caterpillar are poisoned and produce a most disagreeable sensation

with these wasp-like parasites that they are fully as particular about what they eat as are the caterpillars themselves. The mother wasp will not lay her eggs on "just any old caterpillar" any more than will most caterpillars eat "just any old green stuff." It is very interesting and important to know about this, particularly when caterpillars are introduced into a new country. If we should accidentally or intentionally bring the eggs of some caterpillar that thrived on some of our food plants into our country and fail at the same time to bring in its natural enemies, we might have great difficulty in raising those particular food plants successfully. This has happened so frequently that our government has established a system whereby plants brought into our country are examined for the purpose of preventing the introduction of injurious insects, some of which might be moth and butterfly caterpillars. For the same reason our government justly demands that certain materials growing in certain areas shall not be moved into other areas. If you read the account of the fight being made against the gipsy moth, which appeared in the September, 1924, Leaflet, you may get some idea of how serious a proposition this may be. The September, 1920, Leaflet told you also of the campaign to limit the activities of the European corn borer.

If I should quote too many examples, you might get the idea that the caterpillars of moths and butterflies are never desirable creatures. It would be unfortunate to have such an impression because there are thousands of people in the world who do nothing but feed and care for caterpillars for a living. To spend ones time worrying about the health

and the appetites of moth caterpillars may not sound like a man-sized job, but in some cases it is very much of a job. As you may know, genuine silk comes from the cocoons spun by silkworm caterpillars. Silk is an extremely valuable product coming indirectly from nature, and it is not surprising to find so many people concerned with its production.

Silkworm caterpillars feed upon the leaves of mulberry trees and are generally not fed on the trees themselves but in trays in which the fresh leaves are placed. In the early days, it was frequently found that these silkworm caterpillars lost their appetites, became sick, and died before spinning their silk. Since large numbers of them did this at about the same time, the silk industry suffered greatly. People could not find what the trouble was. Finally, they called upon a man named Pasteur who discovered that the sickness was due to very small living things known as *bacteria*. He found how silkworms could be reared free from these bacteria, and thus put the silk industry back on its feet. His work in connection with the safety and the health of these lowly caterpillars was one of the things that has lead to many practices now observed in making our lives healthy and happy. Every time you pasteurize milk, you follow a practice established by Pasteur who learned how to help us lead healthy lives, partly through making it possible for caterpillars of silkworm moths to do the same. It was possible for Pasteur to experiment with the bodies of moths and caterpillars in a manner not so convenient with the bodies of humans. This is only one of the many links connecting

man and his behavior with that of other animals.

The silkworms which produce the silk of commerce are not natives of New York State. There are however, a number of native silkworms whose moths are most interesting and fairly common. It might be wise for you to know about these caterpillars for a number of reasons. Besides being our



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LUNA-MOTH CATERPILLAR

This creature does not look much like the beautiful pale green moth that will develop from it



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CECROPIA CATERPILLARS FULLY GROWN, TWO THIRDS NATURAL SIZE

largest moths, the caterpillars of our native silkworms are capable of producing an excellent quality of gut, such as is used on fishhooks and for leaders in fly fishing. Since these leaders are both useful and valuable, you might like to know how they are made.

The caterpillars from which gut may be made satisfactorily are the caterpillars of luna moths, cecropia moths, polyphemus moths, cynthia moths, and promethia moths. These are not equally good but any can produce leaders of good quality. The identification plates in the back of this Leaflet will help you learn to identify these moths and their caterpillars. You may obtain the caterpillars by searching for those that are on the food plants upon which they feed or you may capture the adult moths, allow them to lay their eggs in captivity, and rear the caterpillars from them. The caterpillars are ready to be killed just as they are about to begin spinning their cocoons. If you have a number of the caterpillars, the first one to spin should give you a key to the actions to be expected of its relatives. Generally at about this time they cease eating and after an active, restless, period become rather quiet and give off a fluid excretion. At this time they should be killed by dropping them into a solution of vinegar and salt. They should be left in this vinegar for about one half hour and then opened. The silk glands will appear as silvery white objects on either side of the body. These should be drawn out by sticking needles into the opposite ends of the glands and drawing them out to the desired length or, rather, until the glands have been drawn out to a thickness about the size of an ordinary gut leader. These leaders should be allowed to dry slowly in the shade, possibly by suspending them from rafters with light weights at the lower end.

There is plenty of opportunity for experimentation in connection with the production of these leaders and some of you may enjoy finding just when the gut should be drawn, under what conditions it may be dried most

satisfactorily, and you may find it possible to develop caterpillars capable of producing leaders of a superior quality. All of these things have been worked out with the silkworm of commerce but practically nothing has been done with these native silkworms of our own State.

For one interested in making these leaders it would probably be best to work with cecropia moths. If these are not available, try polyphemus, cynthia, and then the others men-

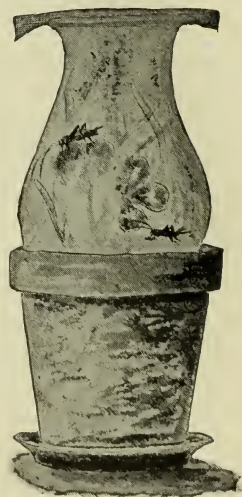


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PROMETHEA CATERPILLARS

These are not so desirable as are cecropia caterpillars for the production of gut

tioned. You may begin your work with the adults, the eggs, the caterpillars, or the cocoons. If you begin by capturing female adults, be sure that the female has been visited by a male before she lays her eggs. You may leave the female out-of-doors over night tied to a twig by a bit of yarn. The males may mate again and again. The females will lay their eggs shortly after mating and deposit them anywhere. You may rear the caterpillars that hatch from these eggs, though they may sometimes keep you busy supplying them with food. Since one female may lay as many as 400 eggs, you will not need many females to start your farming operations on a big scale. It may be wise to kill your caterpillars just as they begin spinning their webs if you are not sure about their being mature. If you begin your farming of moths by collecting cocoons in the fall, it is best to keep the cocoons outdoors rather than inside. I have found that a most satisfactory place is on the inside of a screen covering a window. In this situation the cocoons



SUGGESTION FOR AN OBSERVATION CAGE



TENT-CATERPILLAR NEST

Did you ever try to determine how tent caterpillars increase the size of their tent?

have normal out-of-door conditions and the creatures hatching from them are held captive between the screen and the window glass where they soon come to your attention.

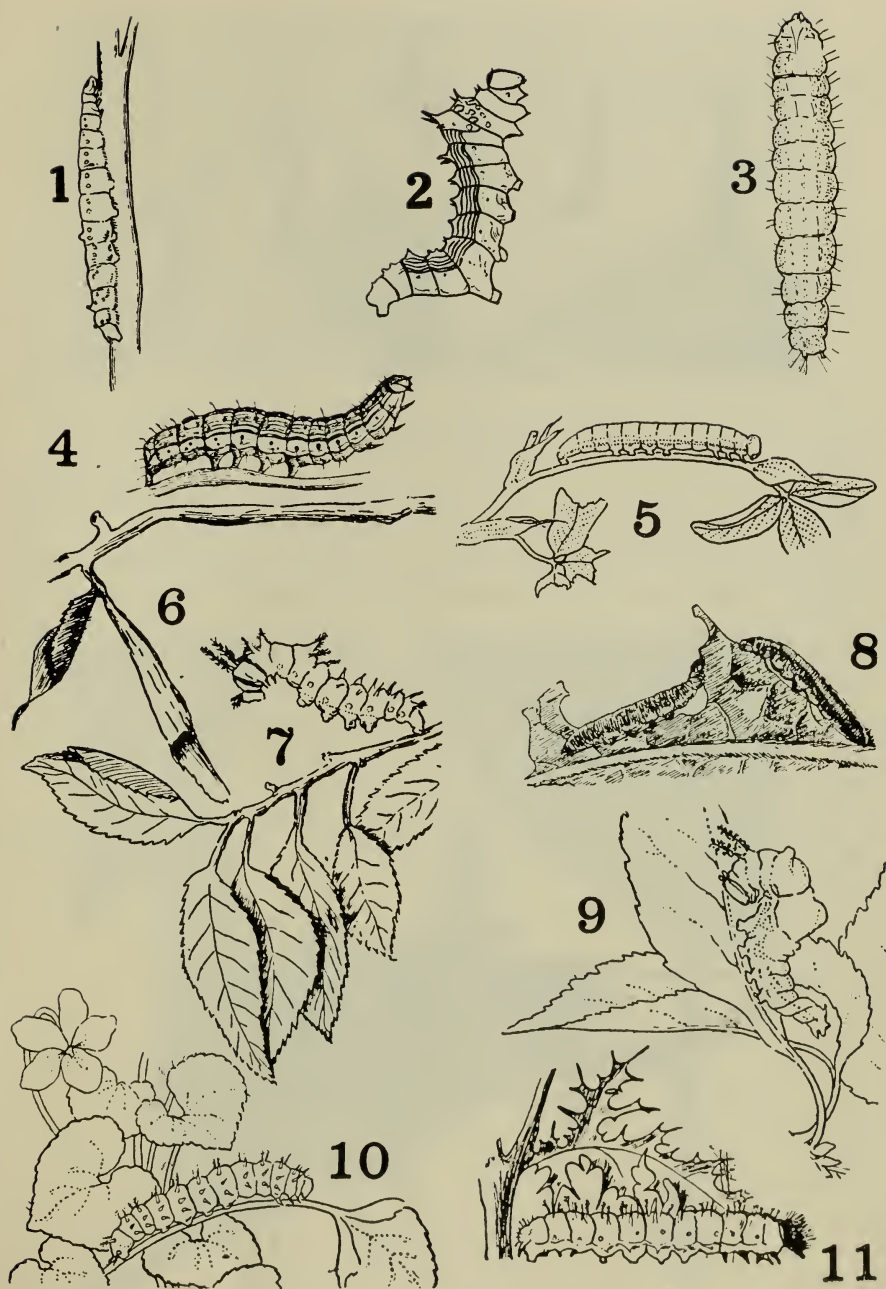
If you undertake the project of rearing caterpillars as I have suggested, you must remember that it may take considerable time to follow the process clear through. Of course, if you are fortunate enough to find caterpillars just about ready to spin, it may be much easier. The whole matter will be worth your while because it will give you an understanding of the life of at least one member of the Mystic Order of Lepidoptera. Good first-class salmon leaders have sold for five dollars apiece. These have, to be sure, been made from Asiatic silkworm caterpillars. Our native cecropia caterpillars can produce gut from six to nine feet long, capable of testing at least four pounds. There are, therefore, possibilities, even though it may be a long time before you may be able to make the most of them. When one thinks of what we have done in cultivating many of the plants and the animals which are useful to us, the cultivation of such

promising and interesting creatures as moth caterpillars does not seem such a difficult problem.

I seem to have wandered a bit from my consideration of the second degree of the Mystic Order of Lepidoptera. Caterpillars of moths and butterflies are so varied in their characteristics, however, that this seemed almost necessary, so I will go on and discuss how we protect our plants from the attacks of these caterpillars by the use of poisons, such as paris green, where this is possible. It is necessary to understand how to protect lofty tree tops from the attacks of such caterpillars as those of canker-worms and tussock moths by banding the trees with sticky barriers. This saves us considerable effort in spraying the tree tops and is fully effective since the caterpillars of these moths get to the tree tops without the use of wings. Since the egg-laying females are wingless and come from the resting stage in or near the ground, it is a simple matter to protect a given tree from the attacks of their caterpillars. This is not nearly so simple when the females are winged, as they are in tent-caterpillar moths, and thus can fly over our barriers. In such cases we must protect our trees through the destruction of the egg masses or the burning of the nests. The problem of burning the nests is interesting, particularly when you sometimes see people burning nests in midday when the caterpillars are feeding. The nests themselves do little damage and their destruction does not seriously inconvenience the caterpillars. The problem of destroying the tents is one which you can best work out by learning to know when the caterpillars are at home and then to act accordingly. Since we prefer to eat apples and cherries in preference to allowing these caterpillars to ruin the crop, we justify our acts accordingly.

A consideration of the means by which we protect plants from the attacks of caterpillars should not confine itself to the work of those forms that feed on plants aboveground. The cutworms that feed underground, destroying many kinds of crops, have to be treated differently. Since these creatures move about underground they may be trapped in trenches baited with poisoned food or controlled by other means. I should also call to your attention the fact that clothes moths do no direct damage as adults. The larvae, however, feed upon our clothing whether it is fine or humble. The caterpillars of clothes moths are not killed by paris green or by painting our wool suits with bands of sticky substances. These caterpillars are killed by fumigating the clothes with sulphur or by some similar means.

I might go on almost indefinitely since the practice which is most effective in controlling one kind of caterpillar may be most ineffectual with others. In practically every case, however, the most effective means of destruction is the encouragement of whatever may be the natural enemies of those caterpillars which we wish to destroy. What all of



CATERPILLARS OF SOME MOTHS AND BUTTERFLIES

1, Under-wing moth; 2, red-humped apple worm; 3, cat-tail moth; 4, corn-ear worm moth; 5, roadside butterfly; 6, victory caterpillar's winter home; 7, viceroy butterfly; 8, cabbage butterfly; 9, red-spotted purple; 10, great spangled fritillary; 11, red admiral



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MOURNING-CLOAK-BUTTERFLY CATERPILLARS

If you find anything like this, it will pay you to watch and determine what happens next

these natural enemies are we do not know. That makes the problem doubly interesting and challenges us to more thorough study. The returns of such efforts have almost invariably justified these efforts. Of course, when we wish to encourage the prosperity of caterpillars, we need to know their enemies to avoid them. If you try to rear cecropia caterpillars through to adult stages, you will find this out for yourself, and in the production of commercial silk from silkworms, it might be an even more important problem. Remember also that what we know about one form of life helps us very frequently to deal with other forms of life. Pasteur has proved this to us if no one else ever did.

Now that we have explored some of the mysteries of the second degree of the Mystic Order of Lepidoptera, let us be initiated into the third degree.



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THE CECROPIA PUPA INSIDE ITS COCOON — NEARLY NATURAL SIZE

The third degree — the pupa

When police examine criminals, they sometimes give them what is known as the *third degree*. This is supposed to be a very severe test and many a criminal has changed his testimony while undergoing that degree. If we wish to consider members of the Order of Lepidoptera as criminals, we will certainly have to admit that when they take their "third degree" they make some most remarkable changes. However, these changes are not limited to the criminal members of the order. When you remember that many of these creatures have to change from a most unattractive creature that can do nothing better than crawl slowly into elegant creatures whose movements have been described as the "soul of motion," you will see that the third degree in the M. O. L. is a very important one.

The manner in which members of the order pass through the pupal stage varies enormously. Generally speaking, the stage is one in which the creature seems to be essentially inactive. This is by no means always true. In many cases the creatures pass the winter in this stage but, as a matter of fact, the winter may be passed in any one of the different stages. In forming our conclusion, we consider all members of the order.



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PROMETHEA COCOONS

Note how the leaves are fastened by silk to the twigs

The beginning of the pupal stage may be marked by the spinning of a cocoon in which the rest and the change is made. Many of our butterflies do this and some of our moths do not, so, if you find a cocoon, you

may be sure that it does not contain a butterfly but probably does contain a moth.

Butterflies pass their third degree in various ways. Some of them make a little swing in which they remain supported, one end of their body being attached to whatever is supporting them. Others merely hang by one end from twigs, their bodies swinging freely in the breeze like so many cradles. Still



COURTESY OF THE COMSTOCK PUBLISHING CO.

A CECROPIA COCOON

Not all of these will produce cecropia moths; why is this so?

others merely hide themselves in trash close to the ground. I am not going to tell you which butterflies do these particular things. You may find this out for yourself from observation or possibly from the life-history charts in the back of this Leaflet.

As I suggested, moths may or may not spend their pupal stage resting in cradles of silk woven into cocoons. Many of you have written me in the last year saying that you have found what looks like a little brown jug buried in garden soil. Almost invariably your description has been definite enough to make me sure that you have found the pupal stage of a tomato worm or one of its near relatives. I have on my desk in a terrarium a large pupa that developed from a "hickory-horned devil" brought me by a scout last fall. This pupa is not in a cocoon and we hope next spring that it will produce a regal walnut-tree moth. There are a considerable number of other moths that spend their pupal stage unprotected by cocoons. Some get protection with trash and some by surrounding earth. Many bury themselves in wood, and some fold themselves in the leaf of a water plant.

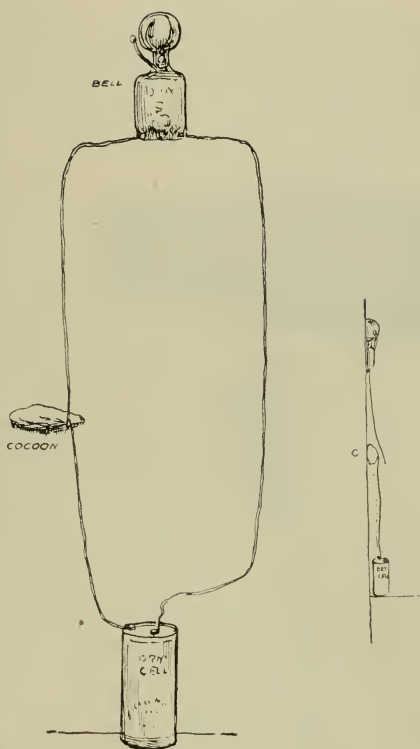
There are, of course, plenty of moths whose caterpillars spin cocoons. Probably the commonest things sent me in the mail are cocoons of one sort

or another, and, if I can believe what you write me, many of you are making collections which you hope will produce moths at some time.

Not infrequently you state that you are disappointed that you were not present when some large moth emerged from a cocoon. Let me suggest that you can set an "alarm clock" on some large cocoons very simply if you have a dry cell and an electric bell. All that is necessary is to substitute the cocoon for the button that will ring the bell. This may be done by so fixing the wires to the bell that when the moth starts to emerge he will push one naked wire up so that it will come in contact with the other, close the circuit, and ring the bell which will call you to see the show. In rigging up a device for this purpose, you may learn something about electric doorbells as well as about moths and cocoons. Some of the older boys in your school

may enjoy rigging up a set like this for the rest of the school. Certainly the job is much simpler than making a radio set work satisfactorily. With a little ingenuity on your part, the same bell may be made to "keep tabs" on a large number of cocoons. If you do not think that this will be fun, try it for yourselves. If you are afraid the bell will ring at night when you are not around and exhaust the dry cell, you can, of course, disconnect it, since the apparatus is of value only when you are where you could conveniently watch what is happening. I know from experience that you will enjoy making a set like this if it is possible.

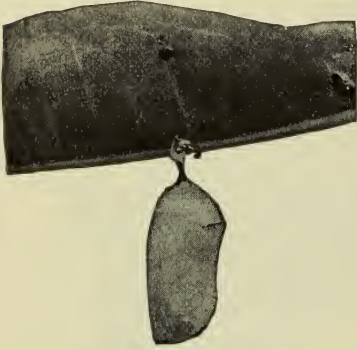
Do not forget to try to keep cocoons in as natural conditions as possible. You should not expect a cecropia cocoon that would normally hang in a tree through all the spring showers to produce a normal moth if it were brought into a dry hot-air heated schoolroom and carefully protected in a shoe box. The more nearly you can duplicate what is normal so far as climatic conditions are concerned, the more normal will your results prob-



A MOTH-COCOON ALARM CLOCK

When the moth emerges from its cocoon, it pushes the wires together, ringing the bell and calling you to see the show

ably be. Many children have written me that their cocoons "hatched" into moths with very deformed wings. This was probably the fault of the children rather than the fault of the moth. Remember also that not all of your cocoons will "hatch." A large number of the pupae may



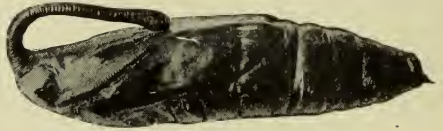
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CHRYSALIS OF MONARCH BUTTERFLY

have been attacked by parasites which killed the creature that would normally have emerged. Many cocoons may have been torn open by birds or injured in other ways. Of course, it is rather difficult for a bird to inflict severe damage on a cocoon that swings free from every beak stroke. Cocoons that are placed against the solid trunk of a tree do not fare so well. It is evident that even though a cocoon may hang conspicuously in the top of a tree, it has a sort of protection not possessed by a cocoon against the bark of the trunk. If you

have the chance to watch a caterpillar spin one of these cocoons, you will be interested to note how the leaf which may be used as a cover is firmly attached to the twig with silk. This is not so with all cocoons using leaves for protection.

While talking about the cocoons of moths it might be well to mention that the silk of commerce is not produced from the silk glands of the caterpillars, as I suggested for the production of gut. The silkworms are allowed to spin their cocoons. The creatures are then killed and the cocoons unwound. If the insects inside the cocoons were allowed to develop and come out as adults, they would cut the threads of the cocoon in escaping and thus ruin them for our use.



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THE THIRD DEGREE OF A SPHINX MOTH



CHRYSALIS OF MOURNING-CLOAK BUTTERFLIES

It is interesting to note in connection with the cocoons of our own silk worms that it is much easier for the creature inside to work his way out than for a creature outside to work his way in. That this is fortunate for the occupant of the cocoon is obvious. You will also find that the creatures in cocoons do not just emerge "any old way." They generally come out at a definite place.



PUPAL STAGE OF SOME MOTHS AND BUTTERFLIES

1, Red admiral; 2, great spangled fritillary; 3, meadow fritillary; 4, pearl crescent; 5, black swallowtail; 6, red-spotted purple; 7, viceroy butterfly; 8, cabbage butterfly; 9, corn-ear worm moth; 10, tiger swallowtail butterfly; 11, roadside butterfly; 12, luna moth; 13, io moth

The fourth degree — the adult

In many human secret societies some candidates never get beyond the third degree. In the Mystic Order of Lepidoptera there are certainly fewer candidates who reach the fourth degree than there are that take any of the other degrees. Many of the eggs are destroyed before they



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THE CECROPIA MOTH



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THE FEMALE PROMETHEA MOTH

develop into larvae. Many larvae do their bit serving as food for birds; many pupae do the same. And so it is of the 400 eggs which may have been laid by a cecropia moth not a single one may survive the hazards which lie between the egg stage and the adult. Some survive or we would



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THE POLYPHEMUS MOTH



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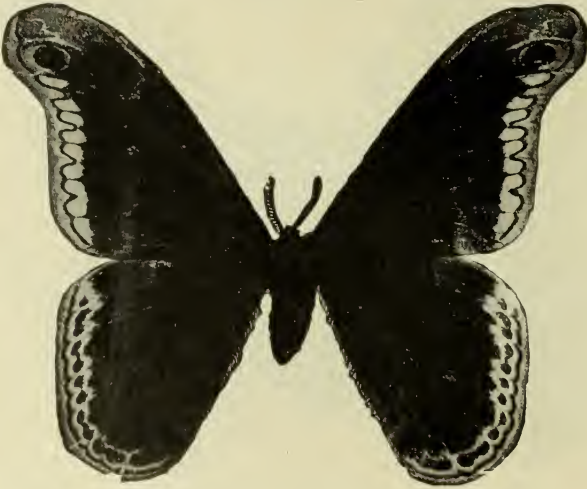
CECROPIA MOTH AND COCOON

soon have no cecropia moths. In order to maintain relatively the same number of moths, only 2 of the 400 need reach maturity and produce fertile eggs. Of course, more than two should reach maturity because



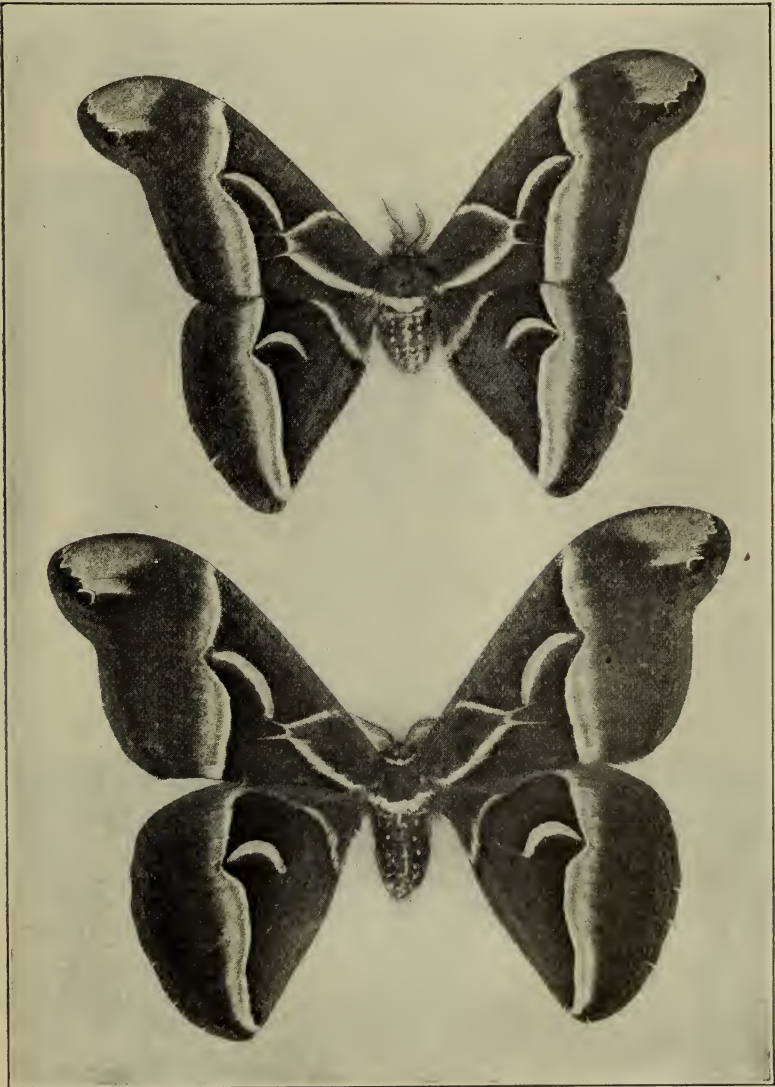
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LUNA MOTH



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THE MALE PROMETHEA MOTH



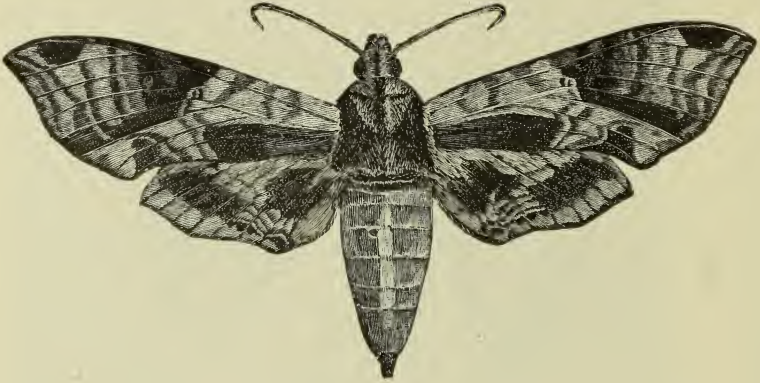
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CYNTHIA MOTHS

These moths were introduced from Asia. They are to be found in this State about New York City. Their caterpillars live upon the leaves of the tree of heaven, ailanthus. The male moth is shown above

many moths are killed by their enemies before they have the time and the opportunity of placing fertile eggs where they may be expected to develop satisfactorily. It should not take any great amount of arithmetic to see that this is so. Neither should it take any great amount to see

what would happen in a few years if but one half of the four hundred eggs laid by a cecropia moth were able to develop to maturity. It would not be long before there would be an insufficient supply of food for all the cecropia-moth caterpillars. This would be a hardship not only to us and



A SPHINX MOTH

These remind us of humming birds. They develop from tomato worms and are active at dusk

to the food plants but even to the cecropia moths themselves. Any kind of animal can live most happily if it produces a number of young for which there can be conveniently provided the food and other necessities and comforts of life which those young demand if they are to develop to the best of their ability. This generalization does not confine itself to cecropia moths, fish, or cattle. In one sense then, the enemies of young cecropia-moth caterpillars are the friends of those that are left, if there is a limited food supply available. It if were not for these enemies, all cecropia-moth caterpillars might have to face starvation. This generalization too does not confine itself to cecropia moths.



THE IO MOTH

Earlier in this Leaflet I told you something about the general characteristics of adult moths and butterflies. The regalia of fourth degree members of the M. O. L. in many cases is more beautiful than anything



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ISABELLA TIGER-MOTHS

These are the adults of woolly-bear caterpillars. The larger is the female

man has ever made. The uniforms of these members all have little scales that rub off easily and this character is what gives the order its name. If the M. O. L. had a secret password it might be "Lepidoptera."



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AN UNDER-WING MOTH

These caterpillars are able to vanish before our eyes on the trunks of trees



THE SILKWORM MOTH

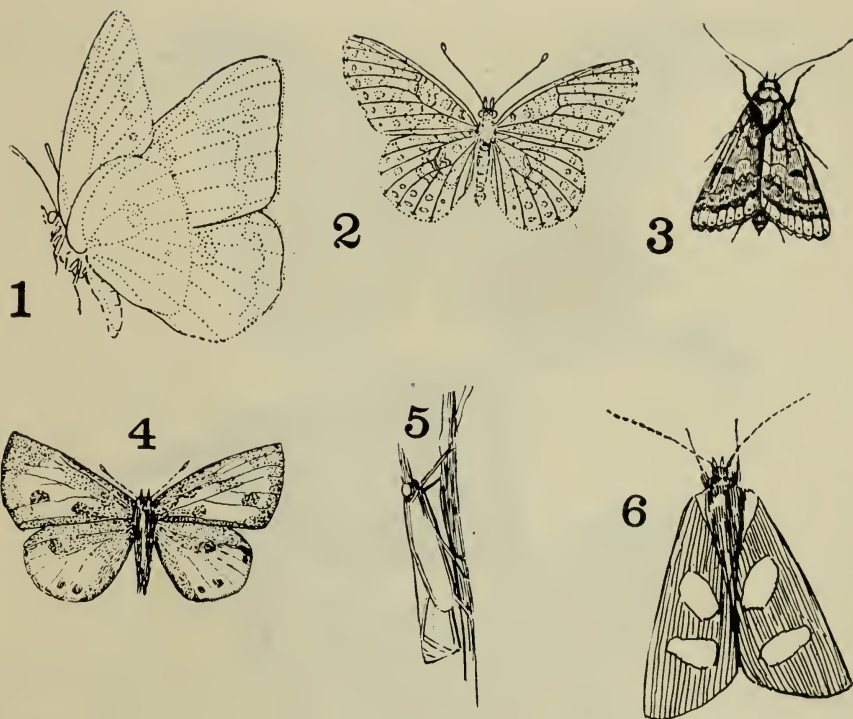
One of the most valuable members of the M. O. L.



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THE GREAT SPANGLED FRITILLARY

The underside of the wing of the great spangled fritillary is shown at the lower left; the silver-spot at the right



ADULT MOTHS AND BUTTERFLIES

1. Roadside butterfly
2. Meadow fritillary butterfly
3. Corn-ear worm moth

4. Wanderer butterfly
5. Snout moth
6. Eight-spotted forester

To many this word would mean nothing, but to those who knew, it would really mean "scale wings." The scales are to be found on the bodies of the candidates as well as on the wings, so creatures without wings still qualify. If you have ever handled a moth or butterfly you have noticed the "dust" that covers its body and wings.

I have written this Leaflet so far without telling you the differences between moths and butterflies. In some ways it is not easy to tell you the exact differences so that everyone reading this might be satisfied. In general, the following differences will hold:

1. Moths, or millers as you may call them, fly mostly at night and many are attracted to lights. When at rest, they either spread their wings horizontally, fold them around their bodies, or fold them like a roof over the back part of their body. Some hold them vertically over their bodies like most butterflies. Moths' antennae vary considerably from broadly feathered structures to thread-like devices. They seldom end in a knob.

2. Butterflies, on the other hand, all fly by day. Most of them, when at rest, hold their wings closed vertically over their backs. In most cases their antennae are thread-like and end in a club at the tip.



SILVER-SPOTTED SKIPPER ABOVE THE NEST OF ITS CATERPILLAR

Much of interest could be written about the behavior of adult moths and butterflies. Concerning their ability to move about, you would find that it varies from many like the female tussock moth that moves no further than to crawl out of its cocoon to butterflies like the monarch butterflies that migrate south with the birds in the fall and then back north again in the spring. Sometimes these monarch butterflies move in large numbers, settling so thickly on trees to rest for the night that they fairly weight the branches down.



MOURNING-CLOAK BUTTERFLY

This adult may be seen at almost any time of year



RED-SPOTTED PURPLE BUTTERFLY



BANDED PURPLE BUTTERFLY



VIOLET TIP BUTTERFLY

Space does not permit more than a word about how remarkably certain moths and butterflies are protected from their enemies through a resemblance of the material on which they rest. The little snout moths that disappear in the grasses of the meadows are rivalled in magical disappearing powers by the large under-wing moths that vanish before our eyes on the trunk of some tree. Other forms more conspicuously colored escape by flight. The ability to fly varies greatly. Some, like the sphinx moths, dart with the agility of humming birds and are frequently confused with these birds. Others fly much more leisurely.

The seasonal appearance of adult moths and butterflies is an interesting study for you to make. In the dead of winter you may see adult mourning-cloak butterflies sailing off over snow banks. Most of the others are less hardy, though the red admiral may be seen in winter. It is in the fall months that we see the viceroy butterfly that mimics the larger monarch butterflies and is, therefore, avoided by many birds which might otherwise eat it. The monarch is distasteful to birds but there is nothing about the viceroy to make it distasteful. If you are a more clever butterfly specialist than the birds, you will note that the viceroy has a black



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VICEROY AND MONARCH BUTTERFLIES

The viceroy is above and the monarch below. How do the markings on their hind wings differ?



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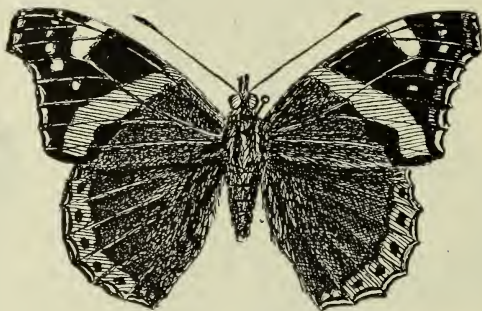
TIGER SWALLOWTAIL BUTTERFLY



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BLACK SWALLOWTAIL BUTTERFLY

band across the hind wings which is lacking in the monarch. The summer months are the season for the coppers and for many other species. One of the most interesting seasonal studies concerns itself with the generations of the spring-azure butterfly. The whitish undersides of the wings



RED ADMIRAL BUTTERFLY

of the first butterflies of the year are more heavily marked with dark than is the case with the later ones. Knowing this, a butterfly specialist can tell whether one of these butterflies which he sees in a collection was captured in early spring or summer.

This brings us to the question of making collections of moths and butterflies. If you are interested in this sort of thing, I am going to ask that you write the College for a copy of Cornell Extension Bulletin 59.



COPPER BUTTERFLY

This little paper by Mrs. Comstock entitled "Hints for Collecting and Preserving Insects" gives you more information than space in this Leaflet permits. It will give you all the necessary information about collecting nets, killing bottles, and other equipment.



SPRING AZURE BUTTERFLY

Male on the left and female on the right

If in this Leaflet I have introduced you into the secrets of the Mystic Order of Lepidoptera so that you will go into the fields this spring and summer and find more interesting things about these insects for yourself, I will be satisfied. As I stated before, the efforts which you put in this direction will not be wasted because these creatures do affect our lives economically and in many other ways. I hope this Leaflet will help you use the members of the order as they deserve to be used.

LIFE HISTORY CHARTS FOR MOTHS AND BUTTERFLIES

Acknowledgment

In addition to his own experiences and studies which are used and have been used in the Life History Charts and Identification Plates, the author has drawn freely from various publications, and to all of these he acknowledges his grateful obligation. In this number, particular credit is due to The Comstock Publishing Company, for permission to publish their copyrighted drawings and for most of the half-tones used in the text; to Dr. W. T. M. Forbes for advice and selection of material and for reviewing pertinent parts; and to others for helpful suggestions.

The references used most repeatedly and which proved most valuable follow.

An Introduction to Entomology. John Henry Comstock. The Comstock Publishing Company, Ithaca, New York. 1924.

Brief Guide to the Commoner Butterflies of the Northern United States and Canada. Samuel Hubbard Scudder. Henry Holt and Company, New York City. 1893.

Caterpillars and Their Moths. Ida Mitchell Eliot and Caroline Gray Soule. The Century Company, New York City. 1902.

Among the Moths and Butterflies. Julia P. Ballard. G. P. Putnam's Sons, New York City. 1899.

Moths and Butterflies. Mary C. Dickerson. Ginn and Company, New York City. 1901.

The Butterfly Book. W. J. Holland. Doubleday and McClure Company, New York City. 1900.

Butterfly and Moth Book. Ellen Robertson-Miller. Charles Scribner's Sons. 1920.

The moth and butterfly life histories already covered in the Leaflets are:

Monarch butterfly	November, 1922
Dingy cut worm	November, 1922
Tent caterpillar	November, 1922
Tussock moth	November, 1922
Fall cankerworm	November, 1922
Case-making clothes moth	January, 1925
Webbing moth	January, 1925

Common name	CAT-TAIL MOTH	SNOUT MOTH	INDIAN-MEAL MOTH	TOMATO WORM; 5-SPOTTED SPHINX MOTH
Scientific name	<i>Lymanæcia phragmitella</i>	<i>Crambus luteolellus</i>	<i>Plodia interpunctella</i>	<i>Phlegethontius quinque-maculatus</i>
Adult Where found	Cat-tail marshes; July evenings	Grasslands during the summer	About feed bins and granaries; summer	About deep-tubed flowers; summer evenings
Wing expanse	$\frac{3}{4}$ inch expanded	$\frac{3}{4}$ to $\frac{1}{2}$ inch expanded	$\frac{1}{2}$ inch	$4\frac{1}{2}$ inches
Appearance	Wings roof-like; slender; pale silky straw-color or light wood-brown, 2 dark dots surrounded with white on fore wings; hind wings, pale gray. Female: stouter	Wings rolled around body; male: apparently with long snout; dark brown, cream, reddish, or dark gray; zigzag brown line near outer edge, no gold fringe. Female: body stouter; without claspers on end of abdomen	Wings folded along back; inner third of fore wings are olive or buff, the outer portion reddish brown with a coppery luster; under wings, lighter and plainer; no great difference in sexes	Males: ash-gray and streaked; five pairs of yellow spots on body; conical; wings, narrow and pointed; tongue very long; antennae, thick and rough. Females: antennae smoother and thinner, otherwise like males
Food	Drinks water only (?)	Does not eat (?)	Usually none	Nectar of deep flowers
Protection	Escape and hide	Like dead grass	Little or no protection	Escape and hide
Use to nature	Possible food for enemies; mate and lay eggs			Assist in pollination
Abundance and range	Common where there are cat-tails; worldwide, Africa, Australia, Europe, America	Common east of the Rockies; often extremely common	Fairly common and general	Common from Canada to Patagonia
Generations a year	One	Two		One or two
Egg Nature	Oval and flattened	Oval and flattened, yellowish		Large, green, spherical, and shining
Where found	On cat-tail spikes	Attached to grass or on rubbish	In grain or meal	On food leaves
Number		About 200		Many laid singly
Incubation		From 6 to 10 days		A short period
Larva Nature	$\frac{1}{2}$ inch long, yellowish white with markings of vague red-brown bands; spin silk in cat-tail heads which prevent seeds from blowing away; winter as part-grown caterpillars; mature in May	White with brown dots and brown head; found in silken web among grass roots; winter as partly-grown caterpillars	Nearly cylindrical; with sparse hairs about as long as body diameter; head small; spin a fine, silken web from seed to seed and fill with excrement which spoils grain for food	Green; about three inches long; stout; row of seven shaded, slanting stripes on each side with equal number of horizontal stripes making a V; good-sized horn at rear
Activity	Crawls leaving web	Crawls	Crawls	Crawls
Food	Pistils of cat-tails and later the seeds	Grass, particularly the hearts; growing corn	Grain and meal	Leaves of tomato, potato, and tobacco
Enemies	Insect eaters and parasites			
Protection	Ability to hide because of burrowing habits			Coloration; ability to hide; will bite
Rôle in nature	Food for enemies; increase bodily stature of individual			
Pupa Nature	Yellowish-brown; $\frac{3}{4}$ inch long in thin, tough, white cocoons	In a weak cocoon	$\frac{1}{8}$ inch; brown in white food-covered cocoon	Like a brown jug with a long "handle" bent back and containing the tongue
Where found	In head or stem of cat-tail	Among grass roots	In grain or meal or in cracks away from bin	Underground
Period	About 30 days	A short period		Over winter or few days
Means of control	Not necessary	Fall plowing; rich fertilizer, particularly potash	Fumigate bins; attend to waste grain	Pick larvae or use arsenate of lead spray, 2 pounds paste to 50 gallons of water
Relation to man's interest	Give cat-tail spikes a characteristic appearance which we might miss	May seriously injure growing corn	Injurious to stored grain	Injurious to tomato, potato, and tobacco

RED-HUMPED CATERPILLAR <i>Schizura concinna</i>	UNDER-WING MOTH <i>Calocala cara</i>	CORN-EAR WORM <i>Heliothis obsoleta</i>	EIGHT-SPOTTED FORESTER <i>Alypia octomaculata</i>
Flies to light at night poorly; July	On tree trunks; August and September	About fields from June through summer	About garden flowers in early summer
1½ inches	From 3 to 3½ inches	1½ inches	1¼ inches
Hold wings like gable of roof; males: gray and white with brown shade along inner margin of fore wing; hind wing white; basal half of antennae feathered. Female: all dark gray and brown with hind wing gray; antennae not at all feathered	Dark gray fore wing folded to make a triangle when at rest; hind wings normally hidden but black and pink banded and beautiful; flashes hind wing when disturbed. Female: slightly stouter and heavier than the male	Extremely variable; some are dull olive green, others are yellowish or brown and with almost no markings; the hind wings are white, with veins black and a black spot	Black with two yellow spots on each fore wing and two white spots on each hind wing; legs yellow; abdomen tufted in male. Females: larger than males and without tufts on abdomen
Nectar	Nectar; comes to bait	Nectar	Nectar
Escape or hide easily	Coloration		
Possible food for enemies; some may assist in pollination; mate and lay eggs			
Common throughout United States, though adult is seldom seen	Common over whole of eastern United States	Too common, particularly in the south; found through United States and elsewhere	Common in United States east of the Rockies
One or two	One	Two	One
White, thin, smooth, finely sculptured	Hemispherical, red, light, ribbed at center of the top	Light yellow, spherical, prettily corrugated	
In clusters on food leaves	In clusters on bark of trees	First on corn, peas, beans; second on corn silk	On woodbine
In clusters	In clusters	Many	Many
A short time	Over winter	From 3 to 5 days	A short time
In colonies; dirty orange color when young; when grown, orange, black, and white; bright red head and forward hump; black pegs on body and hump; winters as caterpillar in cocoon	Late spring; gray and black, spotted with fringe along side making to appear flat; humped behind middle on back; feeds on leaves at night; hides on bark during the days; 3 inches	Variable, light green to black; plain or spotted; full grown in 2½ weeks and from 1¼ to 1½ inches long; when grown, burrow into soil near plant; second generation in ear of corn	Humped; rear with small black knots, about six cross stripes to a segment; head orange; big white spot on side of tail
Crawls; acts like a contortionist	Crawls humping or jumps	Crawls	Crawls; when ready to pupate eats into wood
Apple, plum, maple, birch leaves	Willow	Corn leaves and fruits; peas, beans, cotton	Leaves of woodbine
Parasites; rarely eaten	Parasites and many insect eaters		Not eaten
Ability to hide; throws acid, so beware your eyes	Ability to hide or escape; resembles bark perfectly	Feeds and sleeps hidden	Warning coloration
Food for enemies, increase bodily stature of individual			
In a light cocoon	In a light-brown cocoon with a bloom between leaves	Shining red-brown; 1 inch long	In cocoon half hidden in wood or in burrow
In trash at ground surface first as caterpillar		In cell 1 inch under ground	Burrow entrance closed with wood pieces
Over winter	2 or 3 weeks	2 weeks or over winter	Over winter
Not generally necessary but pick clusters found on newly-set trees	Not generally necessary	Late fall plowing; plant corn early; arsenate of lead on first generation	Hardly necessary
Injures leaves of fruit trees	Not a pest; adults attractive	Destroys from 2 to 3% of corn crop annually; makes raising of green corn in South unsatisfactory	Do little damage; adults are attractive little moths

ISABELLA TIGER MOTH WOOLLY-BEAR CATERPILLAR <i>Isia isabella</i>	YELLOW-BEAR CATERPILLAR <i>Diacrisia virginica</i>	IO MOTH <i>Automeris io</i>	POLYPHEMUS MOTH <i>Telea polyphemus</i>
Nocturnal; active July and August	Nocturnal; active May to September	Flies to light; nocturnal; July	Night flier, generally away from woods
2 inches	1½ inches	From 2½ to 3 inches	From 5 to 6 inches
Male: buff brown with small black spots; hind wings, straw-colored; body dirty orange; body with black spots. Female: flesh-colored hind wings	Male: white, with a few small black dots; wings held like gable roof; body white with yellow side stripes; front legs with yellow spot; antennae broad. Female: antennae not plainly feathered	Wings roof-like or thrown back; male: bright yellow fore wings; hind wing yellow and brilliant red with great black, and blue eye spot in center of each; antennae broadly feathered. Female: fore wings dull purple to brown; antennae not feathered	Wings over back like butterfly; male: fore wing, buff, olive, or gray-brown; with transparent yellow-bordered "eyespot" hind wing with dark border and black eyespot deeply black-bordered. Female: much like male but with antennae not broadly feathered; body of female heavier than in male
No food	No food	No food	No food
Hide	Hide	Night habits; fur (?)	Night habits; coloration
Possible food for enemies; mate and lay eggs			
Common in northern United States from Atlantic to the Pacific	Common in temperate North America	Common in North America east of the Rockies, also northern Mexico	Common all of United States and northern Mexico
One	Two	One or two	One
Yellow, spherical, laid in patches, slightly spaced	Yellow, spherical, laid in patches, slightly spaced	White with a black spot; lying on the side; top-shaped; creamy	Cream colored and brown thick disks (brown in a band)
On anything	On anything	Under leaves of various food plants	Not always on food, generally on under leaf surface
Near to 1000	Several hundred	Clusters of from 20 to 30	300
A short time	From 4 to 5 days	About 10 days	From 10 to 12 days
Furry; red-brown with black ends; very young, social; when grown, sometimes without black ends; winters as almost grown caterpillar; hurry over roads fall or winter	Social when young; variously colored with long soft hairs; body cream to black; hair cream to tawny with some black at front; appear soft	Red-brown at first then yellowish, then bright green with red and white stripe on side; young, social, drawing into a compact mass when disturbed; poisonous prickly spines when mature	Green body with reddish head; very conspicuously segmented when nearly mature with rose-red or pale prickles and silvery tubercles; spiracles bright red; 7 oblique yellow lines on sides
Crawls rapidly or curls up when disturbed		Walk in processions at first but later separate	Walk, snap jaws so as to be heard
A variety of herbs	Practically any herbs	Corn, cherry, elm, willow, apple, oak	Leaves of oak and elm, birch and maple
Parasites and a few birds like cuckoos		Many parasites	Birds, wasps, parasites
Hairs loose, barbed, unpleasant to enemies being loosely fastened like porcupine quills; stiff in isabella; soft in yellow bear		Sting; protective coloration	Resemblance to leaf
Food for enemies; increase in individual bodily stature			
In a gray, felted, hair cocoon	In a gray, felted, hair cocoon	A thin irregular brown cocoon	Thick, strong oval cocoons, that are light, nearly white, and of a continuous thread
Under stones and boards	Under stones and boards	Among leaves on ground	Fall with leaves to the ground or suspended rather weakly
2 weeks	2 weeks or over winter	Over winter	Over winter
Not necessary or desirable	Not necessary; sometimes destroys silk of corn and prevents pollination	Not necessary	Not necessary
Caterpillars interesting and harmless; weed destroyers		Adults interesting; occasionally trouble berry pickers	Adults beautiful; cocoons, possible source of silk gut from larvae

LUNA MOTH <i>Tropaea luna</i>	PROMETHEA MOTH <i>Callosamia promethea</i>	CECROPIA MOTH <i>Samia cecropia</i>	SILKWORM <i>Bombyx mori</i>
Nocturnal during summer	Nocturnal or diurnal; early summer	Woods and swamps in early summer	Not found wild
From 4 to 5 inches	From 3 to 4 inches	From 5 to 6½ inches	
Fore wings thrown back in repose; males: beautiful pale-green moths with small dark eyespots on each wing, hind wing with extraordinarily developed tails; broad antennae. Female: with narrower antennae and much heavier body than in male	Wings folded over back; male: diurnal, smaller, black with clay-colored borders and blue eyespot near tips of fore wings; antennae twice as wide as in female. Female: nocturnal, light brown for the most part; inner half of each wing darker; distinct eye spot near tip of fore wing; light dash on inner half, hind wing	Wings folded over back; males: somewhat like female promethea but with large, light crescent on inner half of each wing; abdomen red banded with black and white. Female: larger than male with narrower feathered antennae; abdomen larger than in male; mate between 1 and 4 a. m.	Wings roof-like with but part of hind wing showing; males: cream color with two or three or more less distinct brownish lines across the fore wings; half eyespot on inner half of hind wing; head small; antennae broadly feathered in both sexes; rarely fly. Females: weak and unable to fly
No food	No food	Eat nothing	Eat nothing
Nocturnal; leaf-like	Hide; male diurnal	Escape and night habits	Domesticated
Possible food for enemies; mate and lay eggs for own kind			
Common	Common	Common from the Atlantic coast to the Rockies	Reared in China, Japan, and southern Europe
Possibly two	Usually one	One	From 1 to 4
Pure white, with some reddish cement	Small; white with much red cement; oval, often with depression	Egg-shaped, pink-white, with red-brown cement	Much like turnip seeds laid haphazard
On twigs and upper side of leaves	On under leaf surface	In rows of from 3 to 20 on leaves of many plants	Anywhere
Over 200	Many in small clusters	300 to 400 in rows	300 to 400
About three weeks	A few days	About 15 days	From 8 to 10 days
Clear green; like polyphemus but with faint vertical, continuous lines over back from side to side; 3 inches long; moults at end of 10, 4, 7, 7, 9 days and spins 18 days later	1st, banded yellow and black; social; mature, 2 inches long, very smooth, clear light green, six rows of shining black tubercles with bluish circles around them, 4 red and 1 yellow tubercles	Black then red; go through moults at 4, 5, 6, 8 days and spin in 10 more; last stage, blue-green with large yellow, red, and blue tubercles, blue on sides; 4 inches long; stage 4 to 9 weeks	Last for 6 to 8 weeks in which larvae grow from ½ inch to 2 inches, shedding skin 4 times; usually white humped back of small head; short spine near rear, like sphinx
Crawls in groups when young	Crawls, remains in groups	Crawls	Crawls
Leaves of willow, hickory, birch, walnut, oak	Cherry, sassafras, ash, sycamore, tulip tree	Box elder, apple, cherry, willow	Leaves of white mulberry
All sorts of insect eaters and parasites		Many parasites and diseases	
Perfect leaf color a protection			Protected by man
Food for enemies; increase bodily stature of own kind			
Cocoons of thin, brown silk; generally, short, thick, egg-shaped	In a leaf enclosed cocoon; females a bit heavier	Tough spindle-shaped cocoon, white at first, stained dull red when finished	In cocoon of silk; half silk being finer than other half; silk possibly 1,000 feet long
In thin cocoon, fall with leaves	Hung firmly to branch of tree by stalk	Hung firmly along twigs	Hung on supports
Short time or winter	3 weeks or over winter	Over winter	
Not necessary	Not necessary	Not necessary	Entirely undesirable to attempt to control it
Moths most attractive and whole life history interesting		Adults most attractive; cocoons possible source of silk; gut from larvae	Silk from all cocoons imported by manufactures of silk in United States in 1920 totaled \$87,728,181

SILVER-SPOTTED SKIPPER <i>Epagyreus tityrus</i>	HOBOMOK SKIPPER <i>Atrytone hobomok</i>	BLACK SWALLOWTAIL <i>Papilio polyxenes</i>	TIGER SWALLOWTAIL <i>Papilio glaucus</i>
About locusts and wisterias; June and July	Grasslands; June and July	Near carrots and the like; May to Sept.	In variety of places; May to Sept.
2 inches	1½ inches	From 3 to 4 inches	From 3 to 5 inches
Wings half-open, quick; male: fore wing, brown with tawny spots above and beneath; hind wing, silver splash on under side, unmarked above. Female lacks a slender fold found along forward edge of fore wing of male	Wings half-open; quick; male: fore wing, tawny with irregular blackish border; hind wing, lemon-yellow beneath with broad irregular brown edge. Female: coarser and heavier; two forms of females, one like male, other blackish, fore wing black with small white spots and center hind wing chocolate brown below	Wings folded; male: fore wing black with double border of yellow spots; hind wing black with double rows of yellow spots with single row of blue ones between; orange beneath and ½ inch tails. Female: yellow spots smaller, blue, larger; without extra spot in cell of hind wing	Wings folded; male: fore wing yellow with black border and black dashes across wings; yellow at base; broad black and blue border; ½ inch tails. Female: larger than male, black stripes broader; a black and blue form with "ghost stripes" is rare on Long Island; clasps of male easily seen
Nectar	Nectar	Nectar	Nectar
Escape	Escape	Escape or hide	Escape
Possible food for enemies; assist in pollination; mate and lay eggs			
Fairly common in all of temperate North America	Abundant in northeastern United States	Common in all of U. S. and southern Can.; varieties from Quebec to Colombia and Cuba	Common in most of United States and southern Canada; except on west coast
One	One	Two	Two
Dome-like, heavy ribbed, grass-green	Smooth hemispheres pale green in color	Smooth; round without markings; yellow-brown	Smooth, green, spherical
On upper surfaces of leaves	On grass	On under side of food leaves	On upper surfaces of leaves
Many laid singly	Many laid singly	Many laid singly	Many laid singly
About 4 days	From 11 to 13 days	From 5 to 10 days	About 10 days
Yellow and green with fine cross stripes; head large, brown with two large orange spots; neck narrow; makes nest of leaflets and silk; nearly 1½ inches long	Slender, yellow-brown, naked body and dark dorsal and lateral stripes; neck, narrow; head, rather large and tapering; makes web nest in grass and winters as mature larva; ¾ inch long	Green, ringed with black, yellow spotted, smooth; young, spined, black with white saddle; mature caterpillar nearly 2 inches long	Green with two large eye spots at front end, and yellow stripe behind; ugly looking and vicious acting; sometimes shows yellow "horns" smooth, nearly 2 inches long
Crawls	Crawls	Crawls	Crawls; rests on silk carpet on a curved leaf
Leaves of locust and wisteria	Grass	Carrots, parsnips, carrot and the like	Leaves of birch, poplar, ash, and cherry
Many sorts of insect eaters and parasites			
Nest and ability to hide		Ability to hide and to startle enemies, offensive odor; perfect concealing pattern	
Food for enemies; increase individual bodily stature			
Plump, about 1 inch long; obscure brown; abdomen not as long as rest of body	Slender and soft with long tongue extending beyond wings, ½ inch long	Cradle-like swung in a threadloop with lower end attached and upper free; brown	Wood-brown cradle-like, in thread loop; 1½ inches; straighter than black swallow-tail
Between leaves on surface of ground in webbing	In cocoon of grass	Erect on plant stems or house walls or boards; rarely on host	Erect on twigs; usually away from host
Over winter	Short	9 days or over winter	2 weeks or over winter
Not necessary	Hardly necessary	Hand picking when on cultivated plants; otherwise useful	Not necessary
Injurious to its food plants but hardly a pest; adults attractive		Larva injurious to a few garden crops but adults a pleasure to the eye	Adults most attractive of butterflies

CABBAGE BUTTERFLY <i>Pieris rapae</i>	ROADSIDE BUTTERFLY <i>Eurymus philodice</i>	GREAT SPANGLED FRITILLARY <i>Argynnis cybele</i>	MEADOW FRITILLARY <i>Brenthis bellona</i>
About fields in summer	In flocks about muddy spots in summer	About fields in late summer	In wet fields in fall
Two inches	From 1½ to 2½ inches	From 3 to 4 inches	From 1.6 to 1.8 inches
Wings folded or open; male: fore wing white above, yellowish below, black tipped, with one black spot sometimes absent in spring; hind wing white, below yellow. Female: fore wing like that of male but with two black spots smaller in spring; hind wing like that of male	Wings folded or open; male: fore wing yellow above with narrow black border. Female: wings broader, usually containing yellow spots; two kinds of females, one yellow and one whiter	Wings open or closed; male: fore wing cinnamon with numerous black markings; round silver spots beneath; hind wing broad yellow stripe, brown hair fringe above. Female like the male except the half of the wings next the body on the upper side is very dark, in male only slightly so.	Wings open or closed, cinnamon brown with numerous black markings; no silver spots beneath. Female slightly larger than male and possibly a bit darker
Nectar	Nectar	Nectar	Nectar
Escape or hide	Escape or hide	Escape or hide	Escape or hide
Possible food for enemies; assist in pollination; mate and lay eggs			
Very common and cosmopolitan; limited to temperate zone	Very common about St. Lawrence River and south to S. C. and west to the Rockies	Common eastern United States and west to Nebraska plains	Common north of the Carolinas through United States and west to the Rockies
Possibly three	Three	One	One to three
Yellow, flask-shaped with 12 vertical ribs	Pale yellow, changing to crimson; slender	Short, cone-like, higher than broad, ribbed, honey yellow	Tall, dull olive, prominently ribbed
Under surfaces of cabbage leaves	On clover and other legumes	Laid near food plant or dropped from flight	Laid singly on food plant
Many laid singly	Many laid singly	Many laid singly	Many laid singly
About 1 week	From 4 to 5 days	About 15 days	From 5 to 9 days
Green with very fine, short hairs and with yellowish back band; ½ inch long	Slender; green, with lighter longitudinal stripes; covered with hairs; over 1 inch long; head lighter in color than body; winters in various stages	At first rough, warty, greenish brown; winter as young caterpillars then mature early following summer becoming black and 1½ inch long; "spines" in belts branching	Olive brown, dark with green markings, apparently "spiny" in belt arrangement; nearly 1 inch long; winters as half-grown caterpillar
Crawls slowly	Crawls slowly	Crawls at night; hides by day	Crawls at night; hides by day
Generally cabbage leaves, mustards	Clover and other legumes	Violet leaves eaten at night	Violet leaves eaten at night
All sorts of insect eaters and many parasites			
Coloration	Excellent hider	Night habit	Night habit
Food for enemies; control for its food; increase individual stature			
Green, slender, angular, ¾ inch long; conical elevation on back in middle	Pale green, straight, pointed but not angular, ¾ inch long; a narrow yellow stripe	Roughened brown coarsely wrinkled; over 1 inch long	Bluish gray with dark spots and two rows of small cones on back over ½ inch long
In silk loop on plant, fences, or elsewhere	Attached to support by silk loop	Hanging by one end to plant	Hanging to plants
10 days or over winter	10 days	From 14 to 24 days	About 1 week
Spray with paris green, from 1 pound to 50 gallons of water	Rarely a pest; the western form a pest of alfalfa	Not necessary	Not necessary
Frequently a pest; not a native of this country; introduced 1860 and 1868; makes chickens sick	Adult interesting	Adults attractive and interesting	

CRESCENT SPOT <i>Phycodes tharos</i>	RED ADMIRAL <i>Vanessa atalanta</i>	MOURNING-CLOAK <i>Ewanessa antiopa</i>	RED-SPOTTED PURPLE <i>Basilarchia astyanax</i>
Open grounds and roadsides; May to Sept.	Open grounds; May or winter	In woodlands commonly, winter or summer	Near woodlands commonly, June to Aug.
1½ inch	2½ inch	From 3 to 3½ inches	From 3 to 3½ inches
Wings open or closed; male: fore wing dull orange with broad black margin and spots; hind wing with a small pearl gray crescent beneath; in spring marbled cream and brown; summer, yellow with brown marginal patch. Female is larger	Wings open or closed; male: fore wing black with white markings at tip and red crossbar; hind wing dark brown with red border speckled with black and blue. Female only slightly different from male. This species winters as adult or as pupa	Wings folded or open; male: fore wing maroon with broad straw-yellow border and blue spots; hind wing like fore wing but with suggested "tails." Female: similar to male; winter as adults; sometimes enter houses in fall	Wings folded or open; male: fore wing black with border of blue dashes and rust spots beneath; hind wing like fore wing but with outer half green or blue-washed; male similar to female, both with red spots on under surfaces
Nectar	Nectar	Nectar	Nectar
Escape and hide	Escape and hide	Escape or hide	Escape or hide
Possible food for enemies; assist in pollination; mate and lay eggs			
Abundant Canada to the tropics	Fairly common North America and Europe	Common in most of northern hemisphere between Arctic Circle and 30° latitude	Common southeastern Can. and northeastern U. S. with closely related western forms
Three	Two	One or two	One or two
Light yellow-green; taper-pointed	Barrel-shaped; delicate green with fine vertical ribs	Dark brown, or black; ribbed; barrel-like	Yellow green to dark brown; globular
Under leaf surface of food plants	Upper leaf surface of food plant	On leaves of food plants in masses	On leaf surfaces of food plants
Clusters of from 25 to 200	Many laid singly	In rings around twig	Many laid singly
From 5 to 10 days	From 5 to 6 days	From 9 to 16 days	From 7 to 9 days
Scatter after hatching; several rows of little soft spines; head, spineless, dark mottled; winters as young caterpillar; from 1 to ½ inch; less than twice as high as broad	With spines; hairs, ½ spine length; color variable; length 1½ inch; head rounded	Black head and body; body spined, white spotted; with red on middle of back; prolegs reddish; two inches long; stay together in groups; head angled	Body naked, humped and irregular; streaked; with a pair of rough black clubbed horns; 1½ inches long; many smooth minute wart-like structures over back; winters as small caterpillar
Crawls	Crawls	Crawls in groups	Crawls slowly and jerkily
Asters, particularly the New England Aster	Nettles and near relatives	Elm, poplar, willow, and hackberry	Plum, apple, pear, and gooseberry
Insect eaters and parasites			
Very expert as hidiers	Hide in a web	Sharp spines	Resembles bird droppings
Food for enemies; increase individual stature			
Variously colored, hangs by tail like fritillaries, gray brown creases; ½ inch long	Ash brown with dark markings and golden spots; over ½ inch long	Dark brown with red-tipped swellings; over 1 inch long; often with whitish bloom	Queerly colored; yellow brown, olive, salmon; nearly 1 inch long; glossy
On plants	On plants	On twigs	Hung on tree
From 10 to 14 days	From 10 days or over	From 8 to 16 days	From 10 to 12 days
Neither necessary nor desirable	Neither necessary nor desirable	Prune off egg clusters if necessary	Not necessary
Larvae destroy weeds; adult is attractive		Adults most attractive and pleasing, particularly in winter in woods	Adults most attractive and pleasing

VICEROY <i>Basilarchia archippus</i>	AMERICAN COPPER <i>Heodes hypophlaeas</i>	SPRING AZURE <i>Lycaena argiolus</i>	WANDERER <i>Feniseca tarquinius</i>
Fields during August and September	Fields and lawns through summer	Field, woods and roadsides; April to August	Moist woods and shady swamps; June to Sept.
From 3 to 3½ inches	From 1 to 1½ inches	From 1 to 1½ inch	1½ inch
Wings generally closed; male: fore wing orange brown, white-spotted black border; veins black; hind wing, like fore-wing but with black line across beyond middle. Female like the male but larger; viceroy resembles monarch except for small size; hind wing cross bar and lack of odor	Wings generally closed; male: fore wing red above with blackish outer border; hind wing, black above with red outer border. Female like the male but with rounder hind wings	Wings usually folded; male: fore wing pale blue above; early butterflies more heavily marked with dark on whitish under side than the later ones. Female: paler blue than the males with broad dark margins; the different generations a single year vary definitely as suggested above	Wings usually folded; male: fore wing tawny with dark markings; hind wing near half tawny; forehalf black. Female; a little more orange
Nectar	Nectar	Nectar	Nectar
Escape or hide	Escape or hide	Escape or hide	Escape or hide
Possible food for enemies; assist in pollination; mate and lay eggs			
Common throughout the United States east of the Sierras	Common from Atlantic to Pacific along our northern border, south to Gulf Belt States.	Common in United States, Canada, and the Old World, and Mexico	Common in eastern United States
Two or three	Two or three	Two	Three
Deep green, globular, pitted	Pale green, nearly hemispherical with large white-walled cells	Short, thick, and green	Flattened spheres, faintly green
Upper or under leaf surfaces of food plants	On stem or leaf of sorrel	In flowers of dogwood, black cohosh in season, or other flowers	Near plant lice
Many laid singly	Many laid singly	Many laid singly	Many laid singly
From 4 to 8 days	From 6 to 10 days	From 4 to 8 days	From 3 to 4 days
Resembles bird droppings as does black spotted purple; irregularly tubercled; a pair of long clubbed and prickled tubercles near front; over 1 inch long; may winter as caterpillar	Small, green head; naked body, green with a dusky line on the back; darker and sometimes rosy on middle of sides; ¾ inch long; very stocky; small head	Very small dark-brown head; body, naked, white with a dusky line on the back; ¾ inch long; very stocky	Whitish bloom; plump with small head, generally all hidden under web with dead bodies of alder-blight aphids; only strictly carnivorous butterfly caterpillar
Crawls; hangs in leaf over winter	Crawls	Crawls or assisted by ants; food-seeking	Crawls
Willows, poplars, and aspens	Sorrel	Stamens and seeds of its food plants.	Alder blight
Many insect eaters and parasites			
Mimics bird droppings	Color	Color	Under web
Food for enemies; and increase in stature of individual			Destroyers of aphids
Like red-spotted purple	Light brown to green and black-dotted; ¾ inch long; very short and smooth	Stocky, light brown to yellow with black marks; ½ inch long; winter as chrysalis	Short, thick and "monkey-face" like; girt
Hung on tree	Under stones	In trash	On branches
From 7 to 10 days	9 days or over winter	10 days or over winter	2 weeks or over winter
Not necessary	Not desirable	Not necessary	Not in the least to be desired
Attractive adult; interesting because of similarity of habits of larvae to red-spotted purple	Weed destroyer; attractive adult, insignificant	Most attractive and interesting little butterflies	Useful as destroyers of useless and injurious insects

CLASSES OF EXHIBITS BASED ON THIS LEAFLET

These exhibits may be entered at the Rural School Exhibit, Farmers' Week, February, 1927, at the New York State College of Agriculture. See the September, 1926, Leaflet.

Note.— But one exhibit of each class mentioned is permitted from a rural school. It is suggested that you hold an exhibit of your work at a school, town, or county fair, in order to decide which shall be entered. The best exhibits should be sent to the Farmers' Week Exhibit.

1. The best collection of mounted moth and butterfly specimens bearing labels showing the names of the collectors, the time of collection, and, if possible, the name of the individual insects.
2. The most interesting gift made, using mounted moths or butterflies either under glass or otherwise.
3. The most interesting account of what you have seen some one moth or butterfly do. This may or may not include or deal with immature stages.
4. The best account of a complete life history of some moth or butterfly observed by the writer of the account.
5. The best drawing of some stage in the life history of a moth or a butterfly.